

December 22, 2000

Mr. J. V. Parrish
Chief Executive Officer
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P.O. Box 968 (Mail Drop 1023)
Richland, WA 99352-0968

SUBJECT: SAFETY EVALUATION OF LICENSEE RESPONSE TO GENERIC LETTER
95-07, "PRESSURE LOCKING AND THERMAL BINDING OF
SAFETY-RELATED POWER-OPERATED GATE VALVES," WNP-2
(TAC NO. M93539)

Dear Mr. Parrish:

On August 17, 1995, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," to request that licensees take actions to ensure that safety-related power-operated gate valves that are susceptible to pressure locking or thermal binding are capable of performing their safety functions.

In a letter of July 12, 1996, Energy Northwest submitted its 180-day response to GL 95-07 for WNP-2. The NRC staff reviewed the licensee's submittal and requested additional information in a letter dated September 4, 1996. In letters of October 15 and November 25, 1996, the licensee provided the additional information. In a letter dated May 13, 1999, the NRC staff requested additional information. The licensee provided the additional information in a letter dated June 30, 1999.

The NRC staff has reviewed the licensee's submittals and finds that the licensee has adequately addressed the actions requested in GL 95-07, as discussed in the enclosed safety evaluation. This closes the staff's efforts in regard to TAC No. M93539. The staff appreciates your efforts in regard to this matter.

Sincerely,

/RA/

Jack Cushing, Project Manager, Section 2
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-397

Enclosure: Safety Evaluation

cc w/encl: See next page

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WNP-2

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO GENERIC LETTER 95-07, "PRESSURE LOCKING AND THERMAL BINDING
OF SAFETY-RELATED POWER-OPERATED GATE VALVES"

ENERGY NORTHWEST

WNP-2

DOCKET NO. 50-397

1.0 INTRODUCTION

Pressure locking and thermal binding represent potential common-cause failure mechanisms that can render redundant safety systems incapable of performing their safety functions. The identifications of susceptible valves and the determination of when the phenomena might occur require a thorough knowledge of components, systems, and plant operations. Pressure locking occurs in flexible-wedge and double-disk gate valves when fluid becomes pressurized inside the valve bonnet and the actuator is not capable of overcoming the additional thrust requirements resulting from the differential pressure created across both valve disks by the pressurized fluid in the valve bonnet. Thermal binding is generally associated with a wedge gate valve that is closed while the system is hot and then is allowed to cool before an attempt is made to open the valve.

Pressure locking or thermal binding occurs as a result of the valve design characteristics (wedge and valve body configuration, flexibility, and material thermal coefficients) when the valve is subjected to specific pressures and temperatures during various modes of plant operation. Operating experience indicates that these situations were not always considered in many plants as part of the design basis for valves.

2.0 REGULATORY REQUIREMENTS

Plant licensing safety analyses and 10 CFR Part 50 (Appendix A, General Design Criteria 1 and 4) require or commit (or both) that licensees design and test safety-related components and systems to provide adequate assurance that those systems can perform their safety functions. Other individual criteria in Appendix A of 10 CFR Part 50 apply to specific systems. In accordance with those regulations and licensing commitments, and under the additional provisions of 10 CFR Part 50 (Appendix B, Criterion XVI), licensees are expected to act to ensure that safety-related power-operated gate valves susceptible to pressure locking or thermal binding are capable of performing their required safety functions.

On August 17, 1995, the NRC issued Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," to request that licensees take certain actions to ensure that safety-related power-operated gate valves that are

susceptible to pressure locking or thermal binding are capable of performing their safety functions within the current licensing basis of the facility. GL 95-07 requested that each licensee, within 180 days of the date of issuance of the generic letter (1) evaluate the operational configurations of safety-related power-operated gate valves in its plant to identify valves that are susceptible to pressure locking or thermal binding, and (2) perform further analyses and take needed corrective actions (or justify longer schedules) to ensure that the susceptible valves, identified in (1) above, are capable of performing their intended safety functions under all modes of plant operation, including test configuration. In addition, GL 95-07 requested that licensees, within 180 days of the date of issuance of the generic letter, provide to the NRC a summary description of (1) the susceptibility evaluation used to determine that valves are or are not susceptible to pressure locking or thermal binding, (2) the results of the susceptibility evaluation, including a listing of the susceptible valves identified, and (3) the corrective actions, or other dispositioning, for the valves identified as susceptible to pressure locking or thermal binding. The NRC issued GL 95-07 as a "compliance backfit" pursuant to 10 CFR 50.109(a)(4)(i) because modification may be necessary to bring facilities into compliance with the rules of the Commission referenced above.

In a letter of July 12, 1996, Washington Public Power Supply System submitted its 180-day response to GL 95-07 for WNP-2. The NRC staff reviewed the licensee's submittal and requested additional information in a letter dated September 4, 1996. In letters of October 15 and November 25, 1996, the licensee provided the additional information. In a letter dated May 13, 1999, the NRC staff requested additional information. The licensee provided the additional information in a letter dated June 30, 1999.

3.0 STAFF EVALUATION

3.1 Scope of Licensee's Review

GL 95-07 requested that licensees evaluate the operational configurations of safety-related power-operated gate valves in their plants to identify valves that are susceptible to pressure locking or thermal binding. The licensee's letters of July 12, October 15, and November 25, 1996, and June 30, 1999, described the scope of valves evaluated in response to GL 95-07. The NRC staff has reviewed the scope of the licensee's susceptibility evaluation performed in response to GL 95-07 and found it complete and acceptable.

Normally open, safety-related power-operated gate valves which are closed for test or surveillance but must return to the open position were evaluated within the scope of GL 95-07 except in the instances when the system/train is declared inoperable in accordance with technical specifications. The staff finds the criteria for determining the scope of power-operated valves for GL 95-07 are consistent with the staff's acceptance of the scope of motor-operated valves associated with GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance."

3.2 Corrective Actions

GL 95-07 requested that licensees, within 180 days, perform further analyses as appropriate, and take appropriate corrective actions (or justify longer schedules), to ensure that the susceptible valves identified are capable of performing their intended safety function under all

modes of plant operation, including test configuration. The licensee's submittals discussed proposed corrective actions to address potential pressure-locking and thermal-binding problems. The staff's evaluation of the licensee's actions is discussed in the following paragraphs:

- a. The licensee stated that the following valves were modified to eliminate the potential for pressure locking:

HPCS-V-15	High Pressure Core Spray (HPCS) Suppression Pool Suction
LPCS-V-5	Low Pressure Core Spray Injection
RCIC-V-13	Reactor Core Isolation Cooling (RCIC) Injection
RHR-V-8	Residual Heat Removal (RHR) Shutdown Cooling Suction
RHR-V-9	RHR Shutdown Cooling Suction
RHR-V-42A/B/C	RHR Low Pressure Coolant Injection Isolation
RHR-V-53A/B	RHR Shutdown Cooling to Reactor Vessel

The staff finds that physical modification to valves susceptible to pressure locking is an appropriate corrective action to ensure operability of the valves and is thus acceptable.

- b. The licensee stated that the following valves will be modified to eliminate the potential for pressure locking:

HPCS-V-4	HPCS Injection
RCIC-V-31	RCIC Pump Suppression Pool Suction

Until these valves are modified, a modified industry gate valve thrust equation was used to demonstrate that the valves are capable of opening during pressure-locking conditions. The staff finds that this calculation provides reasonable assurance that the valves will be operable until the planned modifications to prevent pressure locking are completed as scheduled. HPCS-V-4 and RCIC-V-31 are scheduled to be modified during the Spring 2001 refueling outage. The licensee's commitment to modify these valves in the long term is an acceptable final resolution.

- c. A modified industry gate valve thrust equation was used to calculate the thrust required to open the containment atmosphere control valves, CAC-V-2/6/8/11/13/15/17 (flexible wedge gate valves), during pressure-locking conditions. The results of the modified industry gate valve thrust equation demonstrates that there is adequate margin between calculated pressure-locking thrust and actuator capability.

Pressure locking tests sponsored by the NRC were conducted by Idaho National Engineering and Environmental Laboratory. The results of this testing are documented in NUREG/CR-6611, "Results of Pressure Locking and Thermal Binding Tests of Gate Valves." NUREG/CR-6611 test results demonstrate that the modified industry gate valve thrust equation conservatively estimates the thrust required to open a pressure locked flexible wedge gate valve. The staff finds that the modified industry gate valve thrust equation provides reasonable assurance that flexible wedge gate valves susceptible to pressure locking are capable of performing their intended safety-related function. The staff considers that calculations that are used to demonstrate that valves

can overcome pressure locking are required to meet the requirements of 10 CFR Part 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants, and therefore, controls are required to be in place to ensure that pressure locking thrust prediction methodology requirements and revisions are properly implemented. Until more definitive industry criteria are developed, the staff concludes that the licensee's action to address pressure locking of these flexible wedge gate valves is acceptable.

- d. A modified industry gate valve thrust equation was used to calculate the thrust required to open the HPCS pump minimum flow valve, HPCS-V-12, a double disk gate valve, during pressure-locking conditions. The results of the calculation demonstrated that the margin between calculated pressure locking thrust and actuator capability is approximately 40 percent. Pressure locking tests sponsored by the NRC were conducted by Idaho National Engineering and Environmental Laboratory on a double disk gate valve. The results of this testing are documented in NUREG/CR-6611. Test data demonstrated that the modified industry gate valve thrust equation trended with the pressure locking test results but generally underestimated the thrust required to open a pressure-locked valve. The staff finds that the modified industry gate valve thrust equation provides reasonable assurance that valves susceptible to pressure locking are capable of performing their intended safety-related function provided that the margin between calculated pressure locking thrust and actuator capability is approximately 40 percent. Until more definitive industry criteria are developed, the staff concludes that the licensee's action to address pressure locking of these gate valves is acceptable.
- e. The licensee stated that valves within the scope of GL 95-07 were evaluated for thermal binding. When evaluating whether valves were susceptible to thermal binding, the licensee assumed that thermal binding would not occur below specific temperature thresholds. The screening criteria and operational history results used by the licensee appear to provide a reasonable approach to identify those valves that might be susceptible to thermal binding. Until more definitive industry criteria are developed, the staff concludes that the licensee's actions to address thermal binding of gate valves are acceptable.

4.0 CONCLUSION

On the basis of this evaluation, the NRC staff finds that the licensee has performed appropriate evaluations of the operational configurations of safety-related power-operated gate valves to identify valves at the WNP-2, that are susceptible to pressure locking or thermal binding. In addition, the NRC staff finds that the licensee has taken, or is scheduled to take, appropriate corrective actions to ensure that these valves are capable of performing their intended safety functions. Therefore, the staff concludes that the licensee has adequately addressed the requested actions discussed in GL 95-07.

Principal Contributor: S. Tingen, NRR

Date: December 22, 2000